



(11) **EP 1 835 677 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
19.09.2007 Bulletin 2007/38

(51) Int Cl.:
H04L 27/26^(2006.01) H04B 1/69^(2006.01)

(21) Application number: **06005286.7**

(22) Date of filing: **15.03.2006**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

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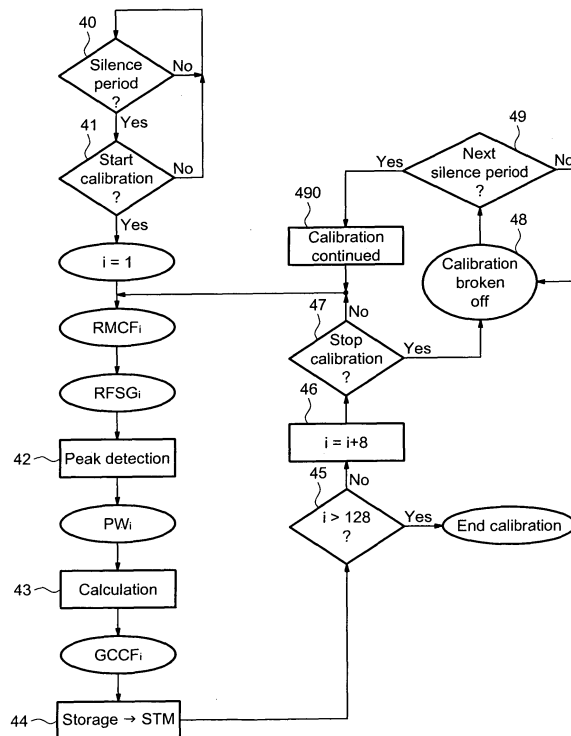
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(54) **Method of calibrating the transmission chain of a wireless transceiver and corresponding wireless transceiver**

(57) The calibration is performed tone per tone during interframe spacing. A peak detection is used for measuring (42) the level of the corresponding signal and a gain

correction coefficient (GCCFi) is stored for correcting the digital complex modulation coefficients provided by the mapping means.

FIG.4



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Description

[0001] The invention relates to the wireless communication systems, and more particularly to the management of the transmit power of wireless transceivers.

[0002] A non-limitative application of the invention is directed to devices operating according to the Ultra Wide Band (UWB) standard based on a multiband OFDM (Orthogonal Frequency-Division Multiplexing), called MBOA (Multiband OFDM Alliance).

[0003] Orthogonal frequency-Division Multiplexing (OFDM) is a method of digital modulation in which a signal is split into several narrowband channels (sub-carriers) at different frequencies.

[0004] Transmit power WLAN or WPAN devices in a network must be precisely controlled. In one hand, it is beneficial to maximize transmit power level to enhance the range and the quality of transmission. In the other hand, it is mandatory to stay below the maximum transmit peak power allowed by the spectrum regulation. However dispersion of integrated circuits characteristics, as well as variations mainly due to operating temperature cause lack of precision of the transmit power level.

[0005] It is thus highly desirable to constantly calibrate the peak transmit power to its optimum level without adding complexity to the WLAN device.

[0006] One difficulty comes from the fact that in an OFDM based transmission, the frequency band of the transmit signal is generally large or even very large (e.g. hundreds of megahertz), resulting in variations of the signal level across the band, and in difficulty to precisely measure the transmitted energy across the whole frequency band.

[0007] One additional difficulty is that, at any time, no spurious emission is authorized by the Regulation. Thus the measurement of the transmit power must be done without radiating energy externally to the tested device.

[0008] The invention intends to solve these problems.

[0009] An aim of the invention is to propose a dynamic transmit power calibration method which can be put in place without minimum modification of the hardware, and without spurious in-air transmission.

[0010] Another aim of the invention is to propose a calibration method which can be performed with relaxed time constraints.

[0011] According to an aspect of the invention, it is thus proposed a method of transmitting a signal from a transmission chain of a wireless transceiver during transmission periods separated by silence periods. Said method comprises performing a transmission phase during said transmission periods, including providing initial modulation coefficients in the frequency domain, and respectively modulating sub-carriers to be transmitted from said initial modulation coefficients. Said method further comprises:

- associating a storage means to each sub-carrier,
- performing a calibration phase including

a) providing a reference modulation coefficient in the frequency domain associated to a chosen sub-carrier and measuring the power of the corresponding reference signal delivered at a location of said transmission chain, during one silence period,

b) calculating from the result of said measurement and from said reference modulation coefficient, a gain correction coefficient for that sub-carrier,

c) storing said calculated gain coefficient in the storage means associated to said sub-carrier,

d) repeating steps a) to c) for other chosen sub-carriers, the steps

a) respectively associated to all chosen sub-carriers being performed during a same or different silence periods, and

- said transmission phase further comprises correcting said initial modulation coefficients with the content of the corresponding storage means.

[0012] In other words, the dynamic measurement of the transmit power is advantageously made tone per tone (a tone is for example equivalent to an OFDM sub-carrier), during for example inter-packets or inter-frames silences. The invention is compliant with wireless systems where packets are transmitted frequently, ideally at regular time intervals (TDMAs scheme), but is also compliant to accommodate any other transmission timing schemes, either deterministic or nondeterministic.

[0013] In a particular but non limitative example, the signal is an UWB signal modulated according to a MB-OFDM modulation scheme, as for example in accordance with the MBOA standard.

[0014] It is only necessary to perform step a) of the calibration phase during a silence period. The other steps of the calibration phase can be performed either during one or several silence periods or during the transmission phases. In other words steps b) and c) can be temporally decorrelated from the time sequence of the signal transmission. Thus relaxed time constraints may be obtained.

[0015] The location where the power measurement is performed is preferably close to the antenna, and for example after the power amplifier stage of the transmission chain.

[0016] And, performing the power measurement just at the output of the power amplifier stage allows highest level measurement for better accuracy while keeping advantage of attenuation and switch isolation from antenna to suppress spurious in-air emission in the calibration phase.

[0017] Thanks to the feature of generating each tone individually, it is possible to use such a peak detector instead of an RMS detector, for measuring the power of the reference signal. This permits to obtain a more simple, low cost and easy integrated circuit implementation.

In particular, it requires a lot less filtering to take out the envelop of the OFDM signal. Accuracy of the measurement is also better.

[0018] When the signal is an UWB signal modulated according to the MBOA standard, step a) and eventually the other steps of calibration phase are preferably performed within the silence periods (called IFS: Interframe spacing) separating successive transmission frames.

[0019] The present invention permits in particular to correct the transmit spectrum flatness variation caused by temperature variation. However, in semiconductor realizations, those variations result in significant changes only after a few second or more. Thus, it is advantageous to start the calibration phase upon reception of a control signal, delivered for example by an upper control layer such as a MAC layer, for example every three or four seconds.

[0020] Further, in the MBOA standard in particular, 3*128 tones or sub-carriers are transmitted within three sub-bands and no noticeable variation in spectrum can be detected within an adjacent group of four or eight tones. Thus, one power measurement per four or eight adjacent tones is generally sufficient and, in such a case, the gain correction coefficient obtained from this measurement is valid for all the four or eight adjacent tones.

[0021] Thus, more generally, according to an embodiment of the invention, the gain correction coefficient calculated in step b) is valid for a group of n adjacent sub-carriers including said chosen sub-carrier, said calculated gain correction coefficient is stored in the storage means associated to said group, and step d) comprises successively respectively repeating steps a) to c) for respective sub-carriers chosen among successive respective adjacent groups of n sub-carriers.

[0022] According to another aspect of the invention, it is also proposed a wireless transceiver, comprising a transmission chain including mapping means adapted to deliver initial modulation coefficients in the frequency domain, antenna means adapted to transmit a signal including sub-carriers respectively modulated from said initial modulation coefficients, and control means adapted to authorize said transmission during transmission periods separated by silence periods. Said transceiver further comprises

- calibration means including:
 - storage means associated to each sub-carrier,
 - generating means adapted to deliver a reference modulation coefficient in the frequency domain associated to a chosen sub-carrier,
 - measurement means connected at a location of said transmission chain and adapted to measure at said location the power of the reference signal corresponding to said reference modulation coefficient,
 - processing means adapted to calculate from the result of said measurement and from the value

of said reference modulation coefficient a gain correction coefficient for that sub-carrier and to store said calculated gain correction coefficient in the storage means associated to said sub-carrier,

- calibration control means adapted to activate at least said generating means and said measurement means during one or several silence periods for several chosen sub-carriers, and
- correction means connected to the output of said mapping means and to the storage means and adapted to correct each initial modulation coefficient with the content of the corresponding storage means.

[0023] The correction means may be for example multiplication means.

[0024] According to an embodiment of the invention, the calibration means further comprises controllable coupling means connected between said location and said measurement means, and said calibration control means are adapted to control said coupling means such that said measurement means are only coupled to said location when the calibration means are activated.

[0025] In other words, it may be advantageous to add a switch or an equivalent circuit for example, in order to insert the measurement means only in the calibration mode, so that no perturbation is caused by the measurement means when the transceiver is in operational or transmission mode.

[0026] According to an embodiment of the invention, the storage means are adapted to store a set of initial values for said gain correction coefficients.

[0027] According to an embodiment of the invention, said silence periods are spaces separating successive transmission frames.

[0028] According to an embodiment of the invention, said calculated gain correction coefficient is valid for a group of n adjacent sub-carriers including said chosen sub-carrier, said calculated gain correction coefficient is stored in the storage means associated to said group, and the calibration control means are adapted to respectively activate the calibration means during one or several silence periods for respective sub-carriers chosen among successive respective adjacent groups of n sub-carriers.

[0029] Other advantages and features of the invention will appear on examining the detailed description of embodiments, these being in no way limiting, and of the appended drawings in which:

- figure 1 illustrates diagrammatically the internal protocol structure of a wireless transceiver according to an embodiment of the invention;
- figure 2 illustrates more in detail the internal structure of the transceiver of figure 1;
- figure 3 illustrates diagrammatically MBOA hopping

- sub-bands; and,
- figures 4 and 5 illustrate a flow chart related to an embodiment of a method according to the invention.

[0030] Figure 1 discloses an example of a wireless communication apparatus or transceiver WAP belonging to a non-coordinated communication system such as a WLAN ("Wireless Local Area Network") or a WPAN ("Wireless Personal Area Network").

[0031] Such a wireless apparatus WAP belongs for example to an OFDM based Ultra Wide Band Communication system.

[0032] WPAN MAC protocols have a distributed nature where there is no central coordinator terminal or base station to assign the medium access. There, in contrast to a mobile radio terminal, a WPAN transceiver has much higher flexibility to allocate the transmission slot and formats. The allocation of the communication resources is a distributed process. The allocation to a specific time slot in the super frame can be modified from one super-frame to the next. The controlling entity is the WPAN-MAC layer of the communicating terminals. The allocation is based on the requested data rate and the type of service to be transmitted. Furthermore, the available resources are taken into account in the allocation process. The MAC layer requests a reservation for a specific time slot or a number of time slots based on these constraints. These constraints can be split into local constraints, like the data rate to be transmitted or received and network wide constraints like the already existing slot reservation.

[0033] An example of distributed WPAN-MAC is MBOA MAC.

[0034] The MBOA standard draft is based on a UWB technology and is planned to be used in the frequency band between 3,1 and 10,7 GHz. First implementations using the standard work in the frequency range between 3,1 GHz and 5,0 GHz.

[0035] The wireless apparatus WAP comprises an OFDM based UWB communication interface MCINT connected between the UWB application block MBLC and the communication medium (here air).

[0036] This communication interface MCINT comprises an UWB MAC layer clocked by a clock signal MCLK and connected to the PHY layer and to the UWB application block MBLC.

[0037] For further details concerning the MAC layer and the PHY layer of the communication interface MCINT, the man skilled in the art may refer to MBOA PHY layer Technical Specification, Version 1.0, January 2005, and to MBOA MAC layer Technical Specification, Version 0v7, October 2004.

[0038] The MAC layer manages in particular the emission/reception of the UWB data stream and is incorporated by software in a control processor.

[0039] In figure 3 it can be seen that the main band of frequencies used for the operation (transmission and/or reception) of the transceiver lies here between 3,1 GHz and 4,9 GHz. Further, the frequency band is subdivided

into three sub-bands SB1, SB2, SB3, called hopping sub-bands, which are mutually spaced. More precisely, there is a guard interval of 100 MHz between the lower limit (3,1 GHz) of the frequency band and the beginning of the first sub-band SB1 as well as between the end of the third sub-band SB3 and the upper limit (4,9 GHz) of the frequency band.

[0040] Further, two adjacent sub-bands are spaced by a guard interval of 50 MHz.

[0041] The allocation of the sub-bands during the transmission is made according to a predetermined hopping sequence.

[0042] Referring now more particularly to figure 2, the communication interface of the transceiver WPA comprises a transmission chain TXCH and a receiving chain RXCH, both coupled to an antenna ANT through a switch or analogue circuit.

[0043] The transmission and receiving chains work in a half duplex scheme. In operating mode the transmit level is much higher than the received level, making impossible simultaneous transmission and reception of the transmitted waveform. This is the reason why a switch or an attenuation system generally exists in order to couple each chain to the antenna only when needed.

[0044] Conventionally, a MB-OFDM digital baseband symbol is composed of 128 sub-carriers (corresponding to data, pilots, etc.). The transmitted data is generated by computing the IFFT (Inverse Fast Fourier Transform) of 128 frequency-domain digital baseband samples and padding the result with 37 zeroed samples. The whole symbol (165 samples) has a duration of 312.5 ns.

[0045] As depicted in figure 2, a transmitter TX according to an embodiment of the invention comprises a digital baseband stage (including an outer transmission block OUTX and an inner transmission block INTX) coupled to an analog radio frequency stage RF by a digital-to-analog conversion stage DAC.

[0046] In a conventional manner, the transmission chain comprises an encoder CC, for example a convolutional encoder, receiving data from source coding means and delivering a bits stream to puncturing means PM which delivers a punctured bits stream.

[0047] Interleaving means ILM are connected to the output of the puncturing means and are followed by mapping means MPM which map the bits into symbols according to a modulation mapping scheme depending on the kind of used modulation, for example a BPSK modulation or more generally a QAM modulation.

[0048] The successive symbols delivered by the mapping means MPM are MB-OFDM digital baseband symbols. Each symbol is a group containing 128 modulation coefficients respectively associated to 128 sub-carriers to be modulated accordingly.

[0049] Of course, a group of 128 samples (modulation coefficients) is delivered on the I branch whereas another corresponding group of 128 samples is delivered on the Q branch.

[0050] These successive frequency domain groups of

digital complex modulation coefficients, which are called here "initial modulation coefficients", are then delivered, after correction (as it will be explained more in details thereafter), to an OFDM modulator IFFT, which performs an IFFT processing in order to associate a modulation coefficient to a sub-carrier and to form an OFDM symbol which comprises 128 modulated sub-carriers.

[0051] The means belonging to the digital baseband stage may be realized for example by software within a microprocessor. Another possibility would consist in realizing at least some of these means, for example IFFT means, by specific ASICs.

[0052] The time-domain symbols delivered by the OFDM modulator IFFT are then processed in the conventional radio frequency stage RF after having been converted into a DAC stage, and before being transmitted on air through antenna ANT.

[0053] Further to these conventional means, the physical layer PHY of the communication interface of the wireless transceiver comprises also calibration means CLM connected to the transmission chain through two controllable switches SW1 and SW2.

[0054] The first switch SW1 is connected upstream the OFDM modulator IFFT whereas the second switch SW2 is located at a second location of the transmission chain. This second location is located after the power amplifier stage of the stage RF.

[0055] Further, multiplication means MLTM are connected between the mapping means MPM and the first switch SW1.

[0056] The calibration means CLM comprises a conventional peak detector PD followed by processing means including a conventional circuit adapted to transform the measured value delivered by the peak detector into its digital representation for further exploitation by the other components of the processing means.

[0057] The calibration means comprises also storage means STM associated to each sub-carrier. More precisely, these storage means may comprise in this example 128 registers respectively associated to the 128 tones or sub-carriers respectively modulated by the 128 digital initial modulation coefficients delivered by the mapping means.

[0058] Another possibility will consist in using a single memory having 128 memory cells located at 128 different addresses.

[0059] The calibration means CLM further comprises generating means MPMA adapted to deliver in the frequency domain a reference modulation coefficient associated to a chosen sub-carrier (a chosen tone). Practically, the generating means may be realized by means identical to the mapping means MPM.

[0060] The calibration means are controlled by calibration control means CLCTM which are adapted to activate the calibration means during one or several silence periods for several chosen sub-carriers, as it will be explained more in details thereafter.

[0061] More precisely, when the calibration means are

activated, the generating means MPMA are actually connected to the OFDM modulator IFFT and the peak detector is actually connected to the output of the power amplifier stage PA.

5 **[0062]** When the calibration means are not activated, the power amplifier stage PA is actually connected to the antenna ANT and the multiplication means MLTM are actually connected to the OFDM modulator IFFT.

10 **[0063]** The processing means PRM may be realized by software within a microcontroller or by a specific ASIC. The calibration control means CLCTM may be realized by logic circuits, for example.

15 **[0064]** Further, in the described example, the calibration control means CLCTM are adapted to activate the calibration means CLM upon reception of a control signal CSGN delivered here by a high level algorithm, for example the MAC layer of the communication interface of the wireless transceiver WPA.

20 **[0065]** The operation of the transceiver, and more particularly the calibration means, will be now described more in details with reference to figures 4 and 5, more particularly.

25 **[0066]** In WLANs or similar wireless systems, the transmission is performed in packet mode, which means that data and signalling are sent by means of subsequent bursts of modulated waveform followed by periods of silence, the minimum duration of which is determined in the related standard. For proper operation, at least some steps of the calibration occur during silence period, implying several consequences:

- detection of the start of a silence period after any transmit or received packet,
- detection of the end of a silence period and any tone measurement ongoing at this time must be stopped instantaneously, or (preferably) the duration of a tone measurement must be shorter than the minimum silence period duration (often called SIFS for Short IFS).

40 **[0067]** Two different solutions are possible for triggering the measurement process at PHY level:

- a) The control process determines after which specific frame (e.g. beacon frames or equivalent in TDMA based networks) the measurement process must occur and presets this start condition in the baseband stage. This is advantageous when the number of measurement per unit of time must be controlled, e.g. for power saving management,
- b) the base band digital stage autonomously detects the next start of a silence period and then automatically processes the tone measurement.

55 **[0068]** The minimum guaranteed silence period (SIFS) being generally very short, the calibration tone generation/measurement are chosen to be short enough to be comprised in a silence period.

[0069] Hereafter an algorithm will be described in the case of TDMA WLANs, where specific messages (e.g. beacon packets) are transmitted frequently enough. This corresponds to the solution a).

[0070] It has to be noted that in non TDMA networks (e.g. non deterministic occurrence of packets), either the network is heavily loaded, meaning that packets and therefore silence periods are very frequent, resulting in solution b), or the network is moderately or lightly loaded, resulting in solution a) or in a combination of solution a) and solution b).

[0071] Here an algorithm is presented in the case of TDMA based wireless networks, where the TDMA cycle is short compared to the variation of the parameters impacting the spectrum flatness of the transmitter.

[0072] A numerical example extracted from MBOA UWB WPAN is the following one:

- the basic TDMA cycle period is 65.536 ms, and at least one specific message called beacon starts each cycle, followed by more messages (typically many). The beacon message is easily detectable by the protocol layer (above the PHY layer),
- the silence period duration (IFS for Interframe Spacing) after each sent packet (called frame at the PHY layer level) is about 10 μ s,
- in semiconductor realizations, most of the transmit spectrum flatness variation is caused by temperature variation, and results in significant changes only after a few seconds or more,
- there are 3* 128 tones (3 sub-bands) and no noticeable variation in spectrum can be detected within an adjacent group of 4 to 8 tones, meaning that one measurement per 4 to 8 adjacent tones is sufficient.

[0073] Although there is a silence period between the OFDM symbols (each including 128 tones), respectively transmitted within the three sub-bands, this silence period (about 10 ns) is too short for performing the tone measurement of the calibration phase.

[0074] Accordingly, in the present example, the silence periods within which a calibration phase is performed are the interframe spacing.

[0075] After the transceiver has been powered on and before any transmission of the UWB signal, a set of initial values for a gain correction coefficients are stored in the storage means STM. These initial values may result from an in-production calibration. These initial values are determined, for example, to obtain a spectrum flatness of the transmitter together with an optimum level of transmitted power.

[0076] As illustrated in figure 4, the calibration phase starts within a silence period. However, since for example in the MBOA UWB WPAN example, there is no significant changes in the spectrum flatness due to temperature variation after a few second or more, it is not necessary to start a calibration within each silence period but for example every three or four seconds.

[0077] It is now assumed that in step 41, the calibration has started.

[0078] For $i=1$, i.e. for the first tone of frequency of sub-carrier, a reference modulation coefficient $RMCF_i$ associated to this chosen sub-carrier, is generated by the generating means MPMA.

[0079] This reference modulation coefficient in the frequency domain is in fact here a chosen constant defining a chosen sub-carrier amplitude coefficient.

[0080] If the generating means are analogous to the mapping means MPM, generating one coefficient for one sub-carrier is equivalent to cancelling all other tones i.e. to delivering zero on all the outputs of the generating means MPMA except for the output associated to the chosen sub-carrier.

[0081] Of course, any other form of OFDM tone generator MPMA can be used, e.g. a CORDIC circuitry (circuitry adapted to perform a well-known COordinate Rotation Digtal Computer algorithm).

[0082] After a frequency domain to time-domain conversion and a digital-to-analog conversion as well as a RF processing, the corresponding reference signal $RF-SG_i$ is delivered at the output of the amplifier stage PA.

[0083] The peak detector PD performs a peak detection (step 42) of this reference signal. The result of this peak detection is a power information PW_i , which represents in fact the amplitude of this reference signal. As the calibration is performed tone per tone, only one sine wave corresponding to a single frequency is sent within the transmission chain. Thus detecting the maximum value of the corresponding signal thanks to the peak detector permits to obtain very simply the power information related to the energy or level of the signal.

[0084] Then, the processing means PRM calculates from this power information PW_i and from the reference modulation coefficient $RMCF_i$, a relative attenuation value of the signal.

[0085] Then, the inverse of this relative value is multiplied (step 43) by the initial value of the corresponding coefficient associated to this sub-carrier for obtaining a gain correction coefficient which is stored in the corresponding register associated to the sub-carrier (step 44).

[0086] This gain correction coefficient is referenced $GCCF_i$.

[0087] Of course, if "i" is greater than 128, then the calibration is stopped (step 45).

[0088] On the contrary, the calibration is continuing by incrementing "i" with 8 (step 46). As a matter of fact, as indicated above, there is no noticeable variation spectrum within an adjacent group of 8 tones, for example. In other words, the gain correction coefficient $GCCF_i$ calculated for sub-carrier 1, is also available for sub-carriers 1-8.

[0089] The calibration process is continuing (steps 42-46) as long as the silence period is not finished.

[0090] However, if during the calibration processing, the end of the silence period is detected, the calibration is broken off (step 48) until next silence period (step 49)

where the calibration is continued (step 490).

[0091] In the present example, all the steps of the calibration phase are performed within one or several silence periods. However, theoretically, only the generation of the reference modulation coefficients as well as the peak detections, are performed within the silence periods. As a matter of fact, the other steps of the calibration phase, i.e. the calculation of the gain correction coefficients, (as well as their storage in the storing means) may be performed within transmission periods.

[0092] Turning now to figure 5, it can be seen that during the transmission period, the initial modulation coefficients IMCFi (i=1 ... 128), which are provided (step 51) from the mapping means MPM, are corrected by the corresponding gain correction coefficients GCCFi stored in the storing means. More precisely, the initial modulation coefficients IMCFi are respectively multiplied by the corresponding gain correction coefficients GCCFi for obtaining corrected modulated coefficients CMCFi which will be delivered to the OFDM modulator IFFTM.

[0093] And in fact, as far as a new gain correction coefficient has not been computed and stored in the storage means STM, the initial modulation coefficients provided by the mapping means MPM are corrected with the previous content of the storage means.

Claims

1. Method of transmitting a signal from a transmission chain of a wireless transceiver during transmission periods separated by silence periods, comprising performing a transmission phase during said transmission periods, including providing initial modulation coefficients in the frequency domain, and respectively modulating sub-carriers to be transmitted from said initial modulation coefficients, **characterized by** the fact that said method further comprises associating a storage means (STM) to each sub-carrier, performing a calibration phase including
 - a) providing a reference modulation coefficient (RMCFi) in the frequency domain associated to a chosen sub-carrier and measuring (42) the power of the corresponding reference signal delivered at a location of said transmission chain, during one silence period,
 - b) calculating (43) from the result (PWi) of said measurement and from said reference modulation coefficient, a gain correction coefficient (GCCFi) for that sub-carrier,
 - c) storing (44) said calculated gain coefficient in the storage means associated to said sub-carrier,
 - d) repeating steps a) to c) for other chosen sub-carriers, the steps a) respectively associated to all chosen sub-carriers being performed during a same or different silence periods, and
2. Method according to claim 1, wherein steps b) and c) are also performed during one or several silence periods.
3. Method according to claim 1 or 2, wherein said location is located after the power amplifier stage (PA) of the transmission chain.
4. Method according to any one of the preceding claims, wherein measuring the power of the reference signal comprises performing a peak detection (42) of said reference signal.
5. Method according to any one of the preceding claims, wherein the calibration phase comprises storing after the transceiver has been powered on and before any transmission of said signal, a set of initial values for said gain correction coefficients in the storage means.
6. Method according to any one of the preceding claims, wherein said signal is an UWB signal modulated according to a MB-OFDM modulation scheme.
7. Method according to claim 6, wherein the silence periods are spaces separating successive transmission frames.
8. Method according to any one of the preceding claims, wherein the gain correction coefficient calculated in step b) is valid for a group of n adjacent sub-carriers including said chosen sub-carrier, said calculated gain correction coefficient is stored in the storage means associated to said group, and step d) comprises successively respectively repeating steps a) to c) for respective sub-carriers chosen among successive respective adjacent groups of n sub-carriers.
9. Method according to any one of the preceding claims, further comprising starting the calibration phase upon reception of a control signal.
10. Wireless transceiver, comprising a transmission chain including mapping means adapted to deliver initial modulation coefficients in the frequency domain, antenna means adapted to transmit a signal including sub-carriers respectively modulated from said initial modulation coefficients, and control means adapted to authorize said transmission during transmission periods separated by silence periods, **characterized by** the fact that said transceiver further comprises

- calibration means (CLM) including storage means associated to each sub-carrier, generating means adapted to deliver a reference modulation coefficient in the frequency domain associated to a chosen sub-carrier, measurement means connected at a location of said transmission chain and adapted to measure at location the power of the reference signal corresponding to said reference modulation coefficient, processing means adapted to calculate from the result of said measurement and from the value of said reference modulation coefficient a gain correction coefficient for that sub-carrier and to store said calculated gain correction coefficient in the storage means associated to said sub-carrier,
 - calibration control means (CLCTM) adapted to activate at least said generating means and said measurement means during one or several silence periods for several chosen sub-carriers, and
 - correction means (MLTM) connected to the output of said mapping means and to the storage means and adapted to correct each initial modulation coefficient with the content of the corresponding storage means.

- 11. Wireless transceiver according to claim 10, wherein said calibration control means are adapted to activate said calibration means during one or several silence periods for said several chosen sub-carriers.

- 12. Wireless transceiver according to claim 10 or 11, wherein said correction means are multiplication means (MLTM).

- 13. Wireless transceiver according to any one of claims 10 to 12, wherein said location is located after the power amplifier stage (PA) of the transmission chain.

- 14. Wireless transceiver according to any one of claims 10 to 13, wherein said measurement means comprises a peak detector.

- 15. Wireless transceiver according to any one of claims 10 to 14, wherein the calibration means (CLM) further comprises controllable coupling means (SW2) connected between said location and said measurement means, and said calibration control means are adapted to control said coupling means such that said measurement means are only coupled to said location when the calibration means are activated.

- 16. Wireless transceiver according to any one of claims 10 to 15, wherein the storage means are adapted to store a set of initial values for said gain correction coefficients.

- 17. Wireless transceiver according to any one of claims 10 to 16, wherein said signal is an UWB signal modulated according to a MB-OFDM modulation scheme.

- 18. Wireless transceiver according to claim 17, wherein said silence periods are spaces separating successive transmission frames.

- 19. Wireless transceiver according to any one of claims 10 to 18, wherein said calculated gain correction coefficient is valid for a group of n adjacent sub-carriers including said chosen sub-carrier, said calculated gain correction coefficient is stored in the storage means associated to said group, and the calibration control means are adapted to respectively activate the calibration means during one or several silence periods for respective sub-carriers chosen among successive respective adjacent groups of n sub-carriers.

- 20. Wireless transceiver according to any one of claims 10 to 19, wherein the calibration control means are adapted to activate the calibration means upon reception of a control signal.

FIG.1

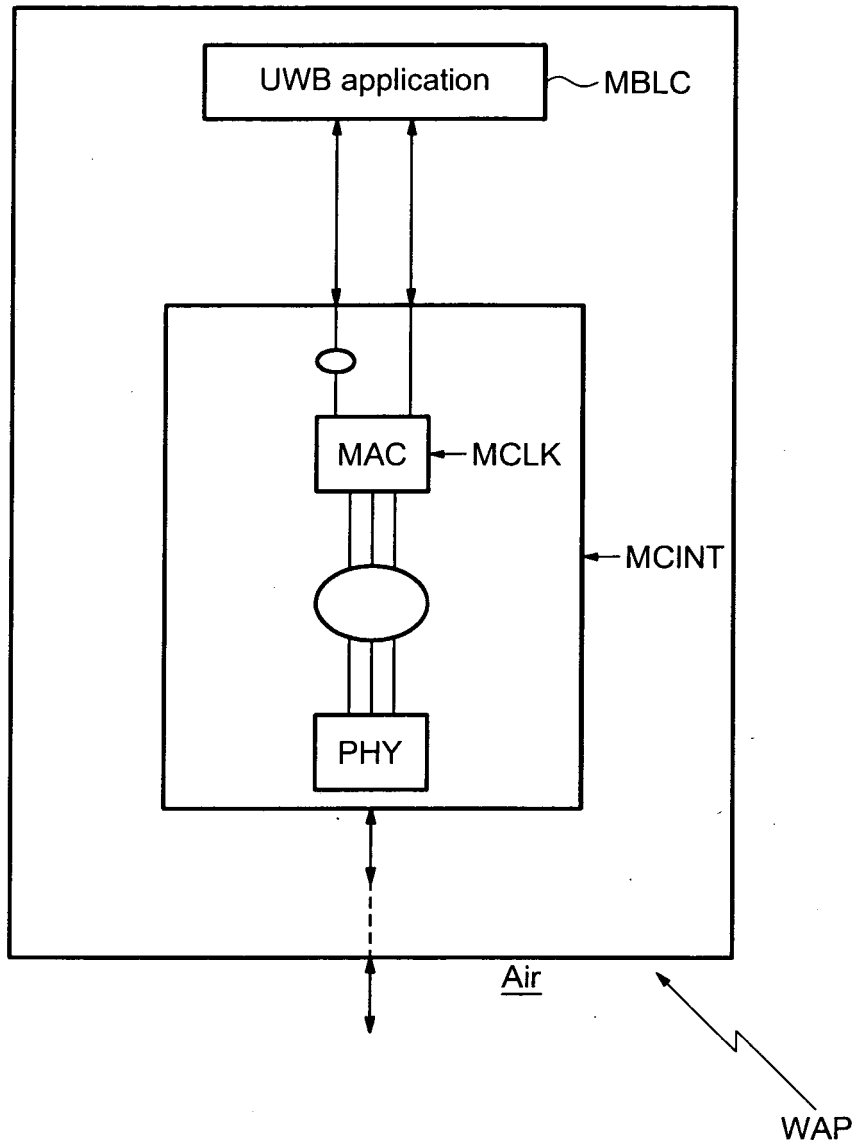


FIG. 2

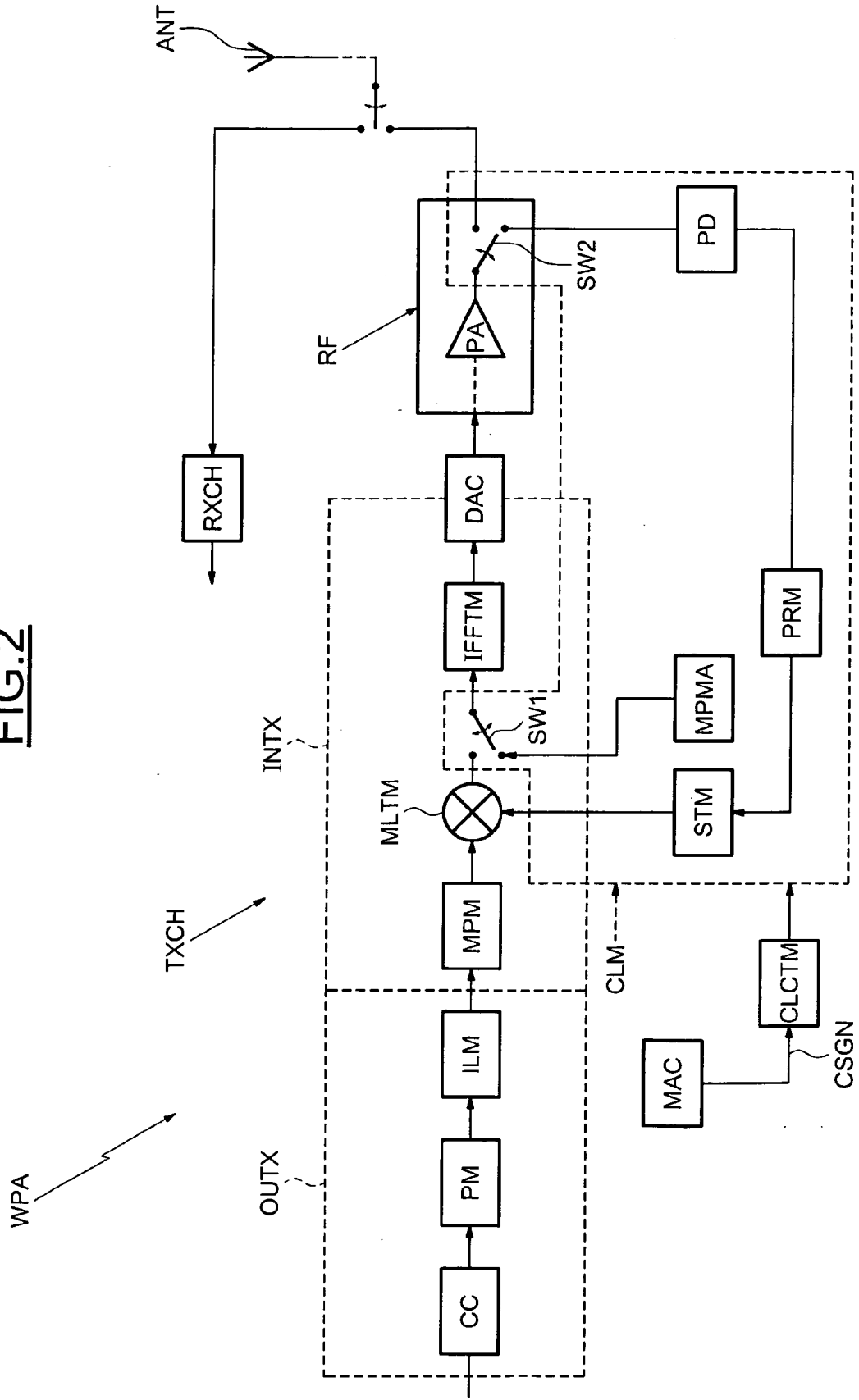


FIG.3

MBOA hopping sub-bands

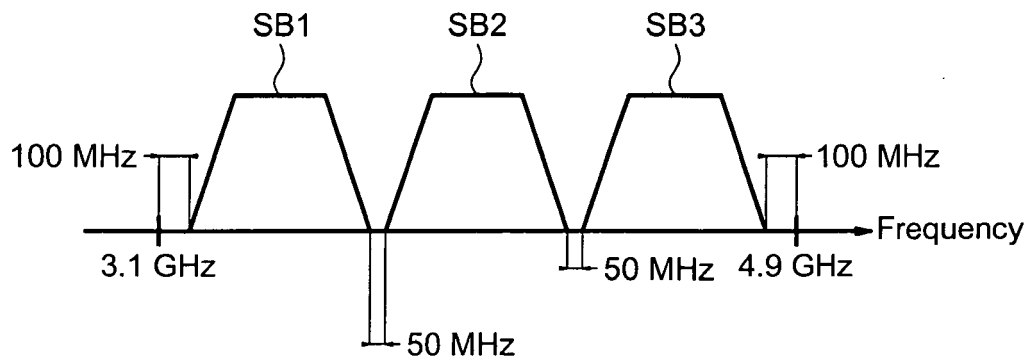


FIG.4

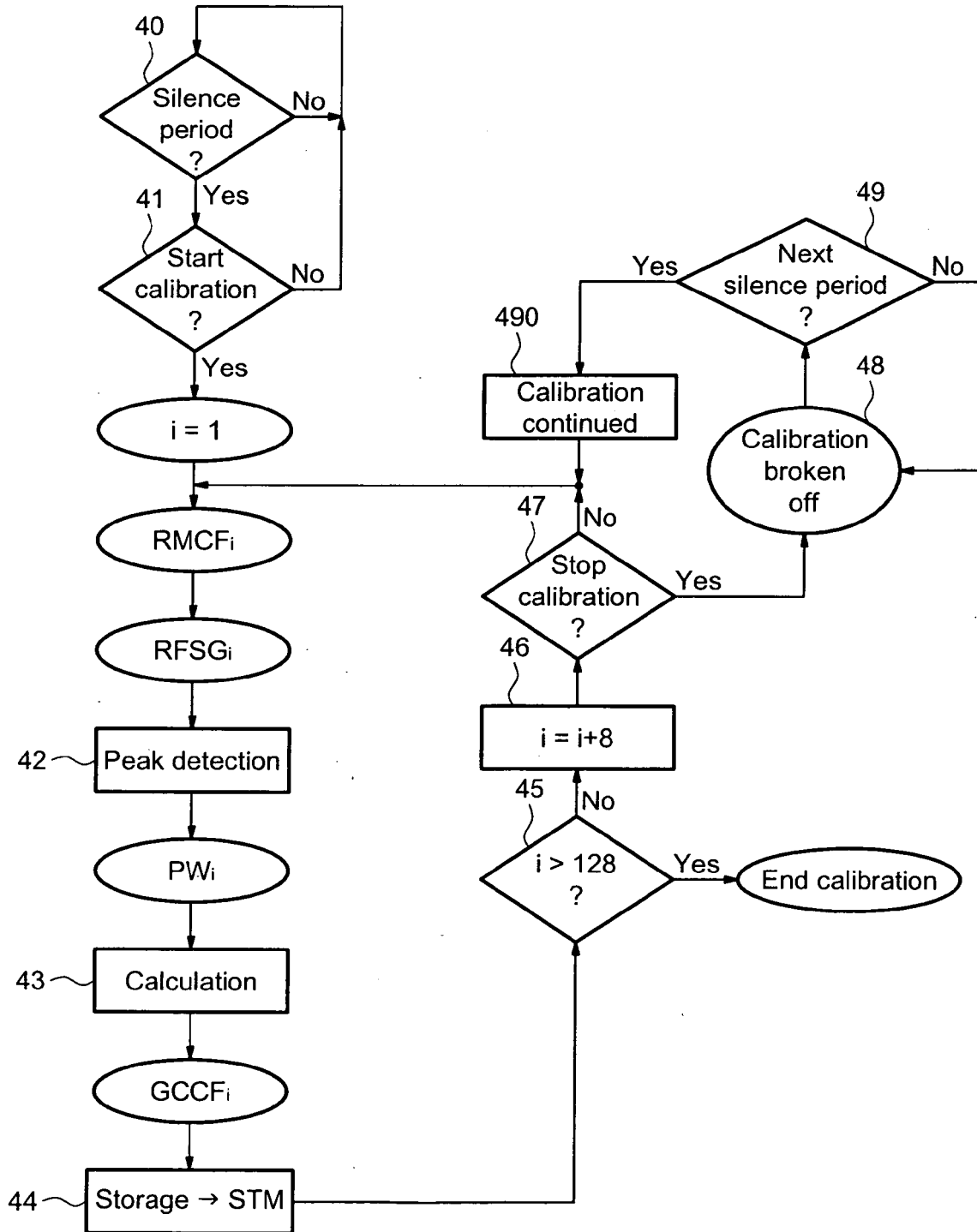
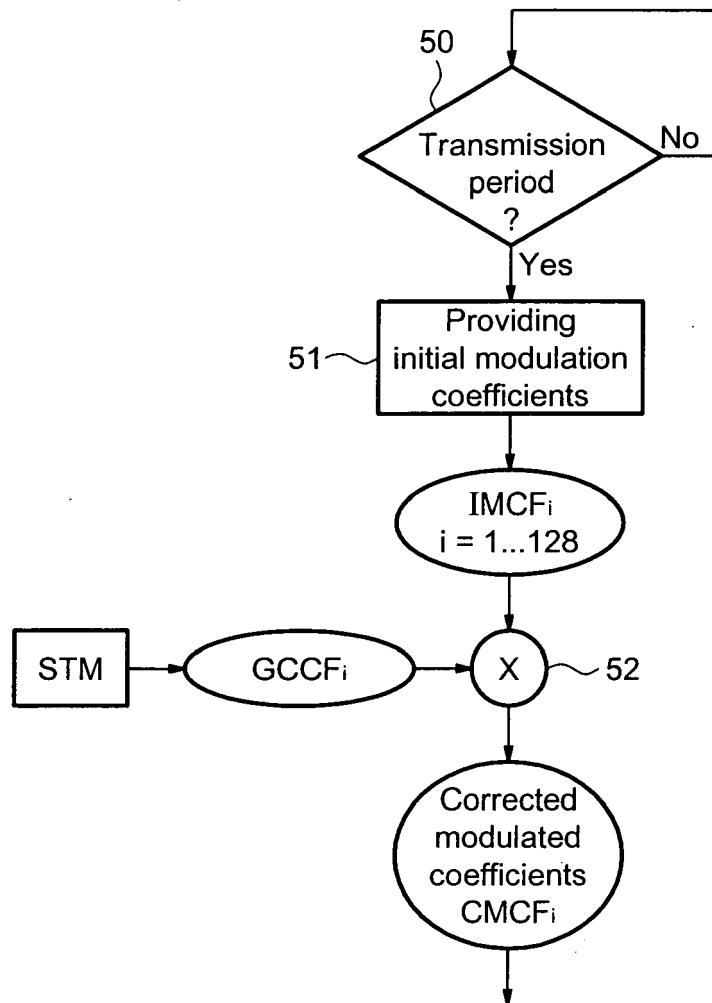


FIG.5





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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			H04L H04B
Place of search		Date of completion of the search	Examiner
Munich		12 September 2006	LOPEZ DE ECHAZARRETA
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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Non-patent literature cited in the description

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- *MBOA MAC layer Technical Specification*, October 2004 [0037]